A Global Strategy for Addressing Global Climate Change

by

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Executive Summary.

Simplistic and counter intuitive as it may be the fate of civilization today hangs on two slender threads – the correct management of livestock and the rapid development of benign energy to sustain cities and mass transport. Excessive emissions of carbon and other gases from fossil fuels are not the only causes of global climate change, nor are they the greatest cause of climate change, as popularly espoused. Humans began to change climate in ancient times through their actions that began to disrupt complex living communities. Diminishing biodiversity and replacing the role of large herbivores and predators in the world's savannas with fire. Ancient practices, continued to this day, ensured land degradation (desertification) and increased atmospheric carbon dioxide and other gases from fires and soil. This process of environment destruction had destroyed many civilizations before coal and oil were discovered or widely used.

Essential as it is, stopping carbon emissions entirely will not alone solve the potential catastrophe facing humanity because a great part of what amounts to global environmental malfunction cannot be attributed to carbon emissions. **If tomorrow we somehow achieved zero emissions from fossil fuels we still would not avert major catastrophe. Grassland and savanna burning would continue, desertification would continue to accelerate with soils increasingly unable to store either carbon or water and the climate continued to change.**

To avert disaster on a scale almost unimaginable a global strategy is required that addresses carbon emissions while effectively dealing with biodiversity loss and biomass burning to reverse desertification that is not caused by atmospheric carbon buildup.

Based on over fifty years of sustained work on the desertification aspect of global climate change, I suggest a strategy that offers hope in today's confusion and lack of any clear and workable strategy at any level - local, governmental or international. This simple strategy may encourage others to improve on what I offer. The strategy suggested follows two distinct paths. A high technology (reductionist science) path to alternative sources of benign energy and a low technology (relationship science) path to removing harmful atmospheric gases, ending biomass burning and reversing desertification as major components of global climate change. As I will explain, ending most biomass burning and reversing desertification can only be achieved through shifting our world view concerning the management of large animals - livestock and wildlife.

While proposing a safe strategy I also argue that measures encouraging high technology solution alone to current legacy load of atmospheric carbon entail risk when such risk is not required. The strategy suggested in this paper sees an essential and vital role for high technology in our search for alternative sources of energy. However the suggested strategy also recognizes the extreme dangers of relying on some technological solution to ongoing biomass burning and land degradation (desertification) and the safe storage of legacy carbon. Most of all much of the suggested strategy treats Earth as the complex

living system that it is and which requires working with rather than against natural functioning of our environment.

Introduction

The global climate changes that concern us so much now started earlier than we assume – roughly a million years ago when humans first learned to use fire. Human-lit grassland fires, which gradually replaced the role of animals in the world's vast savannas and rangelands, released CO_2 and other gases into the atmosphere. They also removed soil-covering litter and vegetation, and the bared soil released previously stored CO_2. Forest burning and then agriculture which followed, further diminished the ability of soils to store CO_2 and thus advanced climate change.

Climate change has accelerated dramatically in the last two centuries due to our heavy use of fossil fuels and the resulting emissions of CO_2 and other heat-retaining gases into the atmosphere. But it has also accelerated due to the development of industrial (oil based) agriculture and the dramatic expansion of the world's deserts. Land degradation (desertification) and climate change are inseparable. Together they have led to the demise of many civilizations in various areas of the world, and they now threaten civilization globally.

Concerned scientists, media and citizens emphasize the need to reduce carbon emissions and look to technology for combating climate change, but that alone will not solve the problem as the land degradation component of climate change is not due to carbon emissions. In fact, as land degrades it releases carbon and adds to emissions.

A Two-Path Strategy is Essential for Combating Combat Climate Change

3. **High Technology Path.** This path, based on mainstream reductionist science, is urgent and vital to the development of alternative energy sources to reduce or halt future emissions.
4. **Low Technology Path.** This path based on the emerging relationship science or holistic world view is vital for resolving the problem of grassland biomass burning, desertification and the safe storage of CO_2, (legacy load) of heat trapping gases that already exist in the atmosphere.

The high technology path is dependent on mainstream reductionist science because no other way is currently imaginable to discover and develop the vast alternative energy sources required; but it cannot solve biomass burning, land degradation and carbon storage problem. The low technology path is based on newer scientific thinking associated with the ongoing shift from a mechanistic to a holistic world view involving systems science and more. The low technology path involves the use of grazing animals (mainly livestock) as the tools that can replace biomass burning and reverse desertification over the world's vast rangelands (the bulk of the Earth's land surface).

Without question solution to global climate change is simply not possible without such a two pronged approach because ending carbon emissions alone does not address the greater impetus to climate change associated with burning and desertification.

Part 1.
Is the Climate Really Changing?

Some parts of the Earth are getting colder while others become warmer. Overall, average temperatures are rising and the weather appears to be increasingly more erratic and violent. Because Earth's climate is largely influenced by the life upon it, and because that life functions within complex communities of organisms that have been altered dramatically, we are now committed to substantial climate changes.

Professor James Lovelock an independent British scientist long ago wrote about the Earth with its life forms functioning as though it were one large living organism - Gaia.

Imagine for a moment Earth as the small ball it is in the universe. What would its climate be without its thin skin of living soil, grasslands, forests, wetlands and ocean life? For a start there would be no oxygen in the atmosphere. Then consider the vast amounts of carbon, derived from millions of years of plant life, stored in oil and coal, which now provides the fuel that warms or cools our homes, or drives our cars, and the resulting waste products that spew into the atmosphere. Consider the vast areas of rangelands turned to desert by mankind and the vast areas of croplands eroding rapidly away, or the state-sized chunks of tropical forest being logged and burned every day to produce annual plant crops. Then consider the many large herbivores that evolved with our grasslands plants and soils, and whose role in keeping them healthy humans have replaced by fire on billions of acres annually. Entire continents, such as Australia documented by Tim Flannery, once covered with fire phobic vegetation, have been converted by humankind to fire-dependent vegetation.

It would be impossible for the climate, dependent as it is on this thin film of life, not to be changing.

Three environmental issues give cause for the global catastrophe we face:

- Biodiversity loss
- Land degradation (often called desertification)
- Global climate change.

Given the prevailing predominantly reductionist world view, these three issues are treated as distinct, almost unrelated, problems as we see in scientific papers, textbooks, conference agenda, missions of non-governmental organizations and media reporting on climate change, biodiversity loss or desertification. In the emerging holistic world view, biodiversity loss, land degradation (desertification) and global climate change are a single, indivisible problem – massive environmental malfunction. They are in reality three sides of the same coin that cannot be treated as separate problems. Treating, or

planning any strategy to deal with, massive environmental malfunction as three separate problems as we are doing today is a recipe for failure.

How can biodiversity loss, desertification and climate change be inseparable?

Biodiversity is defined as more than simply the genetic and species diversity of plant and animal life. The definition of biodiversity encompasses the full functioning of biological processes and communities. When bulk plant material (biomass), *including litter providing soil cover* is lost vast changes throughout the environment begin gradually at first. Temperature, water and soil/air balance along with changes in soil life lead, if unchecked, ultimately to land degradation and in seasonal rainfall environments to desertification. The entire process begins with changes in local micro-environment ultimately followed, when vast forests have gone, or vast deserts have formed, in macro-climate change. Land degradation is a symptom of biodiversity loss which tragically is generally not recognized till charismatic species are threatened with extinction. The dead canary in the mine, over most of Earth's land surface, is disappearing soil-covering litter from dead plant material.

Best and Worst case Scenarios.

The best case scenario we face due to global climate change, assuming our rapid response, is massive social disruption and its associated violence, with the greatest suffering occurring ultimately in the cities, many of which could fail entirely and be abandoned. The mainstream view that rural people will suffer most is unlikely. While rural populations are the first to suffer as is already happening over large swaths of Africa in social breakdown, violence and genocide, it is our large city-based populations who will later experience the greatest violence and suffering.

The worst case scenario we face is run away climate change with a high probability that all higher life forms become extinct. As with previous extinctions new life forms will evolve, but without humans.

When changes take place in nature they follow an exponential growth curve. Anytime growth is exponential, speedy action is critical. If you want to slow the growth, every day, month, or worse, year, of procrastination carries a shocking cost. It is thus neither alarmism nor exaggeration to stress that when it comes to combating climate change, time is the one luxury we no longer have.

Part 2
Technology Alone is Not the Right Answer for Dealing with Excessive Carbon Already in the Atmosphere

There is much focus today on high tech solutions to ending carbon emissions from fossil fuels, which is appropriate. However, with regard to the removal of excessive carbon dioxide and other gases already added to our atmosphere, past experience tells us that a high-tech quick fix is almost certain to produce unintended consequences followed by

further fixes in a damaging spiral we cannot afford to risk. Whole books have been written about the unintended consequences of technology when dealing with nature. The phenomenon of fixes for fixes of fixes is universal.

Moreover, the current focus on carbon emissions from fossil fuels ignores the massive annual burning of the world's grasslands and savannas and its enormous impact on global climate change.

Given the Earth's shifting crust, any concentrated bulk underground storage of excess atmospheric carbon can be expected at some point to be interrupted with catastrophic consequence.

Storage of excess atmospheric carbon deep in our oceans presents similar uncertainties, as well as the potential for acidification and ecosystem malfunction in deep ocean environments.

The gravity of the situation suggests we should not consider any high-tech quick fix removal of atmospheric carbon until at least the risk-free and permanent alternatives have been truly considered.

Part 3
How Healthy Land Can Store Massive Amounts of Atmospheric Carbon Naturally, Safely and at Low Cost

Aside from risky and costly underground storage and deep ocean storage, which require technological intervention, there are two natural places where the required amounts of carbon can be safely sequestered for many thousands of years – *in living biological systems* occurring in oceans and soils.

Oceans: Action is Required Immediately, Because Biodiversity Recovery and Return of Carbon-Storing Capability Will Take Time

For oceans to store carbon as they have done for millions of years it is necessary to restore oceanic biological communities to full functioning. With urgency, we need to end our abuse of the myriad life forms, of which plankton are but one, that are today being seriously damaged by fossil fuel based pollution (plastics, chemicals, etc) as well as by over fishing. We have also to end the massive soil erosion from our land management practices resulting in loss of ocean life due to excessive silt loads reaching ocean shelves. There is in the case of the oceans no room for delay or complacency because the more the biological community and its diversity is damaged, the slower the recovery, and the longer it will take to restore the oceans' former carbon-storing capacity.

Soils: Keep them Covered to Increase Organic Matter and Soil Life - and to Store Atmospheric Carbon

For the Earth's soils to once more sequester carbon as they formerly did it is essential to restore living soils with ever increasing organic matter and the abundant life forms that help produce it. Relatively small increases in soil organic matter amount to billions of tons of carbon stored safely and permanently over billions of acres of land. Conversely, relatively small decreases in soil organic matter result in vast amounts of carbon released to the atmosphere.

It is the restoration of healthy soils that is biggest hope for immediate salvation because of the time it will now take to restore normal ecological functioning to our vast oceans and the relative ease of increasing soil cover and organic matter.

An important spinoff with humans soon to fight worse wars over water than over oil, is that any increase in soil organic matter and improvement in soil structure, which is again dependent on soil life, also greatly increases the rate of water infiltration and retention in soil. The amount of water that can be held in the ground through healthy soils dwarfs the storage in the World's largest dams. This in turn helps minimize the frequency and severity of most of today's floods and droughts that are not caused by any weather change but by land degradation. On rangelands improving soil health may also enhance the storage of inorganic carbon, which is more common in arid areas. The science about inorganic carbon storage in arid soils remains fuzzy, but it is a reasonable assumption that improving the effectiveness of the water cycle, through reversing degradation of the world's rangelands, is likely to increase inorganic carbon sequestration because water plays a role in most soil chemical reactions.

Creating Healthy Cropland Soils: Most are Degrading—a New Agriculture is Required

Excessive soil exposure throughout most of the year leads to soil degradation, and the excessive use of chemicals and pesticides further compounds the problem. Although industrial agriculture, which promotes both practices, was hailed as the answer to feeding the world, it has proved highly damaging to soils, illustrating once again the challenges arising from technological fixes for nature's processes.

Independent scientists involved in sustainable agriculture estimate that the entire legacy carbon load could be absorbed in the world's croplands, were they properly managed. What is certain is that an enormous amount of carbon could be sequestered, given improved agriculture. World wide, most cropland soils, whether rain-fed or irrigated, have lost much of their organic matter and soil life, resulting in more rapid soil erosion than at any time in history—about 21 gigatons per year on croplands alone, which is more erosion than continental glaciers managed at their peak during the Pleistocene Ice Age (*New Scientist* 18 December 2006). Recent estimates put the amount of eroding soil annually going down the world's rivers at about 24 billions tons or 4 tons per human alive today.

Neither industrial agriculture nor organic agriculture as currently practiced can sustain global civilization. The industrial model fails because it is fossil-fuel based, a net carbon emitter, not only because of emissions from machinery, but because it destroys the ability of cropland soils to store carbon and water. The organic model is much closer to a solution, but it isn't focused on the needs of a population predicted to rise to 9 billion people living mostly in cities. And historically, what today's sustainable agricultural movement describes as sustainable agriculture is the same form of agriculture that led to the demise of more than twenty civilizations world wide through biodiversity loss and land degradation.

We need a new form of agriculture close to today's organic cropping practices that can provide easily harvestable and transportable excesses to feed urban populations. The new agriculture will need to be truly holistic in that it mimics nature and restores soil health—keeping soils permanently covered with cropping practices more akin to nature's polyculture complexity than today's single-crop fields that leave the soil bare between plants and rows and, in many cases, over the entire non-growing season.

Such a new agriculture will remove and store carbon from the atmosphere risk-free, while also increasing water retention. The knowledge to begin doing much of what is required is already available within the sustainable agriculture movement and refinements addressing the reasons for past failures would arise quickly once good minds and resources on focused on the need.

Creating Healthy Rangelands: Most are Deteriorating—Livestock Can Be Used to Reverse the Trend

According to the United Nations, one-third of the earth's land surface (10 billion acres/4 billion hectares) is threatened by desertification, the bulk of which is rangelands. And this estimate is conservative. Rangelands are similar to croplands in that if the soil is bare any time of the year, they will deteriorate and release carbon previously stored. At the same time the ability of such rangelands to store water are reduced. Because so much of the soil in rangeland areas is bare – grasslands that appear healthy to anyone driving by in a vehicle commonly have 50% to 90% of the soil bare and exposed between plants - the erosion figures from them dwarf the dramatic figures recorded for croplands.

The generally accepted wisdom is that livestock overgrazing and trampling is responsible for a major part of the damage, but, using a simple grazing planning procedure that I (working with many ranchers in Africa) developed more than 40 years ago, and field-tested on rangelands the world over, livestock can be used to restore rangelands to health and productivity. *In fact, as we have discovered, only through increasing livestock numbers while planning their concentration and movement carefully can desertification be reversed on most rangelands.* Once restored, rangelands can store even more carbon than croplands can for two reasons: the rangelands of the world dwarf the croplands in size; and most croplands support annual plants with lesser root volume and depth than the perennial plants of healthy rangelands. Root volume and depth is crucial to both carbon and water storage in soils.

The planning procedure for livestock that I developed mimics the movement and grazing patterns of the wild herds of old, minimizing overgrazing of plants while harnessing the beneficial soil-preparation effects of trampling hooves that knock down old vegetation, chip bare soil surfaces, and cover them with fertilizer (dung and urine). The increase in vegetation that results gradually fills in bare spaces, keeping the soil covered year round, and once again storing both carbon and water. The grazing planning procedure, combined with the rest of what has become known as Holistic Management, not only enables us to massively reduce carbon dioxide in our atmosphere, it also helps ensure food and water security. What's more, it produces greater revenue for land managers than the cost of implementation, while generating a truly sustainable form of wealth in healthier, more productive, land. Further detail available in "Holistic Management: A New Framework for Decision Making" Second Edition, Island Press 1999"

How Much Carbon Can We Really Store in Healthy Rangelands?
The dry rangelands alone are estimated to constitute over 4.9 billion hectares, and the medium to higher rainfall grasslands increase the area significantly. A small increase in soil organic matter over these billions of acres would remove billions of tons of carbon from the atmosphere.

To provide illustrative figures, consider the present 12 million hectares already managed holistically across Australia, Africa, Mexico, Canada and the United States. To understand the following figures, a couple of definitions are needed: one *gigaton* is one billion tons; *CO_2e,* or carbon dioxide equivalent, is the internationally recognized measure of greenhouse emissions.

Increasing soil organic matter by the easily attainable target of 1 percent on 12 million hectares removes 3.6 gigatons of CO_2e. Increasing soil organic matter 3 percent, which is probably already being achieved on the better soil areas on those 12 million hectares, of course removes even more atmospheric carbon.

On the 4.9 billion hectares that make up the world's rangelands increasing soil organic matter by a mere 0.5 percent, amounts to approximately 720 gigatons of CO_2e removed from the atmosphere. For comparison, the annual total emissions from all sources for the year 2000 was an estimated 44 gigatons. Achieving the reasonably easy average of 2% increased soil organic matter over the bulk of the world's rangelands magnifies the sequestered CO_2e to 2,880 gigatons while addressing grassland biomass burning and desertification.

Most important reversing desertification on the world's rangelands as is now possible addresses simultaneously storage of carbon and water while reducing the frequency and severity of both floods and droughts. And in so doing removes much of the tinder underlying the constant outbreaks of violence associated with desertification.

Part 4.

The Urgent Need to Reduce Biomass Burning

According to one NASA expert, every year a land area half the size of Africa is burned at some point. This biomass burning occurs in forests, which get most of the attention, and much more extensively in the world's grasslands where the practice has a long tradition. Biomass burning releases CO_2 into the atmosphere. In fact biomass burning accounts for 40 percent of $C0_2$ annual production. French research has shown that a one and a half acre median (average intensity) grassland fire releases more carbon dioxide than 3,694 cars *per second* and more nitrous oxide than about 1,400 cars *per second*. Many of Africa's fires—over 2 billion acres burn annually—rage for hours or days.

A current example provides additional perspective to grassland burning. In early 2007, the BBC news reported that the London-based department store chain, Marks and Spencer, was going to spend £200 million (US$ 400 million) on a five-year plan to make the company carbon neutral. Marks and Spencer Chief Executive Stuart Rose was quoted saying that the company's major carbon neutral shift was estimated to achieve savings equivalent to 100,000 cars being taken off the road annually. While this is a truly admirable effort, it pales when compared to the CO_2 contributions from biomass burning. Converted to car days per year, Marks and Spencer's 100,000 cars would be equal to 365 million car days/year. Taking the known emissions from grassland fires, this is the approximate equivalent of the emissions from one 15-acre grass fire in Kansas, Kenya or Zimbabwe, burning for 15 to 20 minutes!

African experts such as this example from a recent BBC report illustrates are not correct when they state *"Africa is being cheated again by the industrialised West,"* says Jacob Nyanganji of Nigeria's University of Maiduguri. *"Africa does not produce any significant amount of greenhouse gases, but it's our lakes and rivers that are drying up. America has refused to ratify Kyoto and it is our lakes that are drying up."*

The Justification for Grassland Burning and the Overlooked Damage it Does to Soils

Sometime within the last 100,000 years, human populations began altering entire continents using fire, mainly as a hunting aid as was first well documented by Australian scientific writer Tim Flannery. Today, grassland burning is advocated by major environmental organizations as well as governments, resulting in billions of acres burning every year, often as management policy. While climatologists often warn that the burning of tropical forests is contributing to global warming, they seldom mention the greater annual burning of the world's grasslands other than to excuse, pardon or praise the practice as being necessary for grassland health.

Some scientists argue that CO_2 and other gases that reach the atmosphere as a result of grassland fires is not significant because it is subsequently withdrawn from the atmosphere by the next season's growth of grass. And this does occur. But the argument ignores the many months that CO_2, nitrous oxide and other gases produced by the fires remain in the atmosphere and the affect the fire has on the land. The soil exposed by the

fire heats up in sunlight and releases carbon and also water (through surface evaporation). That in turn reduces soil life and organic matter, impairs the subsequent growth of plants, and when the rains return they are less effective (less soaks in and more evaporates or runs off) as desertification increases.

The main justification for grassland burning today is to induce sprouting regrowth. A fire clears away old, stale leaves that damage grass plants retarding new growth. Removing old leaves that weaken plants also helps prevent damaged grassland giving way to brush. A fire causes plants to flush green earlier in the new growing season, in some cases even before the first rains fall. For way too long a time, the soil damage produced by frequent burning was overlooked because there appeared to be no alternative to fire as for most of human existence we have only had two tools with which to manage our environment at large – fire and technology - from early chipped stones or pointed sticks to today's machinery or chemicals.

The Alternative to Grassland Burning: Livestock Under Holistic Planned Grazing

An alternative to grassland burning and inevitable desertification first became apparent to me working as a young biologist/game ranger in Africa in the 1950s. Studying the damage experienced through government policy to burn Africa's grasslands I could not help but observe that the healthiest land was associated with remnant wild populations of large game animals. Where large populations of thousands of buffalo and other game, complete with packs of lions that followed closely and kept the herds bunched, the soil and vegetation was healthiest. What the wild, large concentrated herds did not consume, they trampled onto the ground, thus removing the old growth and preparing both plants and soils for new growth. The animals in intact communities were doing what we were using fire to do, but doing it better with no adverse effects of soil, wetlands, springs and rivers.

The world's vast savannas and grasslands developed over millions of years with soil, soil life, plants, grazing herbivores and their predators—all acting as one vast indivisible functioning whole in nature. The world's large grazing animals tend to run in herds as a defense strategy against pack-hunting predators. The larger the number of animals, both prey and predator, the larger the herd masses. Such herding grazers have what are referred to as non-self-regulating populations. This means their numbers are only controlled by accident, disease or predation, rather than any innate breeding control. Because they cannot regulate their own numbers these populations were often enormous with numbers running to many millions.

The diaries of early travelers in Africa and the Americas record vast herds, which in all likelihood were but remnants of earlier much larger numbers. In the early 1800s, for instance, some 17,000 antelope were shot in a one-day hunt provided for the Prince of Wales in South Africa. Records kept by early South African pioneers describe substantial wetlands, sponges and springs associated with the vast herds but which dried up rapidly as soon as the herds were killed off and their former role was replaced with fire.

Today with far fewer numbers still, the same land is considered desert, despite no change in rainfall. The evidence appears strong that large numbers were the rule rather than the exception in the grasslands humans inherited. And yet to save these grasslands today, the common prescription is to reduce or remove the animals, especially livestock, so the grasses and soils can "recover" and then to burn the old material to keep the plants alive.

In fact, only large herbivores, wild and domestic, can restore grasslands to their former health and productivity on the scale needed and with the speed required. They can replace the need for frequent burning, which pollutes the atmosphere and exposes soils, while enhancing the production of organic matter and maintaining soil cover. What's more, they provide these services while also producing food and fiber for people. Since we generally aim to keep wild animals wild, the large herbivores most easily harnessed for this task are livestock. Under Holistic Management planned grazing they become tools for land reclamation, while also producing sustenance or a profit for those managing them.

Today some 12 million hectares of rangeland are under holistic planned grazing in the U.S., Canada, Mexico, Africa and Australia mainly. Many are the people witnessing the reversal of desertification using greatly increased livestock numbers integrated with wildlife.

Part 5.

The Vilification of Livestock as a Cause of Global Climate Change Versus the Truth: They're a Vital Part of the Solution to Climate Change

While livestock are the only practical and readily available tool with which to reverse the degradation of the world's rangelands to address this aspect of global climate change, we face an extraordinary situation of great confusion and danger. Powerful bureaucracies, such as the United Nations Food & Agriculture Organization (FAO), and major environmental organizations, ably assisted by the media, are today vilifying livestock, cattle in particular. Take, for example, the recently released FAO report that cattle are responsible for more greenhouse gases than automobiles. The report calls attention to how much methane cows produce, as well as the high amount of water required to produce a pound of beef or gallon of milk.

What is consistently ignored is the fact that what is actually being condemned by the research is industrial agriculture with its factory model of animal production. Because mainstream institutional researchers and others are not distinguishing between animals in factory settings, overfed grains they did not evolve to eat, and animals grazing on ranges as they evolved to do, they are doing untold damage by causing unnecessary confusion.

The world's enormous population, increasingly in cities, needs to be fed and healthy meat and milk will be required. To reverse desertification world wide will require many millions more cattle, goats, donkeys, sheep and camels than we have today. To illustrate

this need for increased livestock to reverse desertification, which is counter intuitive, I am involved in assisting the Africa Centre for Holistic Management managing rangeland in Zimbabwe. On this land they are running 400% more livestock than it originally did. Through two recent serious droughts they have increased livestock further and the river that had gone dry in most years is once more flowing perennially in most years supporting a great increase in animal life. Both the retention of water and carbon, which follows a similar fate being linked to soil organic matter, have increased. Visiting range scientists from the Cape to Ethiopia are now benefitting from this case study example.

It is counter-productive to quote numbers of cattle, assume ranges are overstocked and then condemn meat production. Take Texas as one example. The official USDA stocking rate for cattle in West Texas a hundred years ago today looks like science fiction. Travel any day through hundreds of miles of West Texas and you are likely to count less than 100 head of cattle in 300 miles. The ranges you will drive through exhibit mile after mile of dying grassland with generally over 80% bare soil between plants, and being severely invaded by woody plants. As you travel, you might pass one of the feedlot concentration areas conveniently positioned for cheap grain transport, and here you will smell before you see the hundreds of thousands of animals in pens being force fed grain as they are readied for slaughter.

It is these animals we need desperately to get out of pens and back onto rangelands and to increase dramatically if we are to restore rangelands to health and address global climate change to save our cities.

Part 6.
The Need for a Holistic World View

We need to recognize at a deep level our dependence on the environment, yet we are disassociated from it. Example: Nobel Prizes are awarded for so many areas of endeavor, but not for agriculture or the environment.

The earliest beginning of the holistic world view of which I am aware, because he brought it into the English scientific literature, occurred with the publication of Holism and Evolution in 1926 by Jan Christian Smuts. While others, since Smuts, have involved themselves in philosophical holism I chose to avoid this path in favour of learning how we could actually make decisions holistically because past civilizations and peoples that undoubtedly thought more holistically and were more in tune with nature still succumbed to environmental degradation.

The aim of science is to understand nature. And nature, as Smuts warned, only functions in complex wholes, patterns and relationships, for which Smuts coined the term holistic as there was no known word in any language to describe such complexity. James Lovelock subsequently made the concept of the universe and this Earth functioning as a whole more understandable to lay people with his idea of Gaia portraying the vital role of Earth's life forms regulating climate. Strides in mainstream science since 1926 have confirmed Smut's view. We see this acknowledgement of complexity in many branches

of science including more recent Theory of Chaos and Systems Science. I acknowledge Smuts by using the term holistic that he coined to describe nature functioning in complex self-renewing relationships rather than through interconnecting parts like some complicated machine.

Although many scientists today are calling for a more holistic approach to management as our world view shifts doing so does not provide a complete solution. It would be arrogant to believe we are the first humans to truly see our connection to the environment or to think more holistically. Many primitive civilizations that deeply identified with the environment contributed to large scale ecosystem degradation. Why?

The Holistic World View and Decision Making that Make the Low Technology or Relationship Science Path Possible

By the early 1970s in southern Africa ranchers working with me developing the early forms of planned grazing with increased livestock were achieving amazing results in land restoration. Where this could never be achieved with the tools historically acceptable – technology (all forms), fire and rest (leaving things to "nature") – two new tools were being used to produce that restoration. These were *grazing* and *animal impact* from large herbivores such as livestock. Using initially a 1,600 hectare area of land that had turned to desert, where all perennial grasses had disappeared, the London-based Liebigs Company, in then Rhodesia, trebled cattle numbers using simple planned grazing. This process I developed from British military planning as taught at Sandhurst because it had hundreds of years of experience behind it, and because range management science had no experience of such planning to deal with complex situations that could change daily. The Liebigs project resulted in rapid reversal of desertification with the return of healthy perennial grassland which was maintained through all manner of seasons. Similar results were later attained on numerous ranches in Africa and elsewhere.

However, all projects over a four year period failed to varying degrees. Something was still missing and had to be found before we could ensure consistent results. Only in the mid 1980s did the missing pieces fall into place. Since that time hundreds of ranchers have been restoring deteriorating land in several countries on three continents through Holistic Management and its planning procedures. What had been missing was the development of what has become the holistic framework for decision making. Thinking with a holistic world view was not enough, decisions had actually to be made in a manner that could deal with economic, social and environmental complexity simultaneously.

Holistic Framework for Decision Making Described in Brief

Using the holistic framework, people work in whole situations in which people, their resource base and money are seen as inseparable. They acknowledge that while objectives, goals, visions and missions took humans to the moon they did not work well when dealing with the complexity of nature, economies and human aspirations. A new concept, the "holisticgoal" was developed to provide an over-riding direction to goals, objectives, etc., to ensure that in pursuing them people won't veer too far from what they

consider most important in their lives: the quality of life they are seeking; what they have to produce to achieve it, and the resource base (environment) they will have to have to sustain what they produce to create that quality of life. The holisticgoal ties one's deepest spiritual and material values and desires to our life-supporting environment.

Next, four fundamental ecosystem processes are acknowledged as undergirding all human endeavor – water cycle, biological community dynamics, nutrient cycle and solar energy flow. Two new tools (animal impact and grazing), as mentioned, are added to the human tool chest, and, finally, when making the decisions necessary to achieve everyday goals and objectives, a simple filtering set of questions is used to determine whether the decision/action will move one closer to or away from the holisticgoal. These filter questions, when used in conjunction with the holisticgoal, enable one to better handle complexity and to make decisions that are simultaneously economically, socially and environmentally sound, both short and long term.

(See *Holistic Management: A New Framework for Decision Making, by Allan Savory with Jody Butterfield, Island Press, 1999, for an in-depth explanation of the holistic framework).*

Shifting to a More Holistic World View

Only through science will we be able to minimize the suffering in the best possible scenario presented by global climate change. However, science does not operate independent of the prevailing world view. We are currently undergoing a shift in world view and science is undergoing change because of it. The last major shift from the Earth being at the center of the universe to understanding that it was not took a long time to gain universal acceptance.

Fortunately that life and weather on our planet function in wholes, relationships and patterns is today rarely even questioned. That human wellbeing is totally dependent on such relationships functioning holistically in our environment is also fairly well accepted. Adopting a holistic world view, together with holistic decision making in all walks of life simply has to be speeded because global climate change is coming at us like a gigantic tsunami and time is not on our side.

Because the paradigm shift is still occurring, many scientists still in reductionist mindset believe that our environmental problems can be solved with technology whether it be harnessing solar energy in space and beaming it to earth, fertilizing the sea with iron filings or some other technological silver bullet. The strategy suggested in this paper respects this reductionist point of view, and in fact sees an essential and vital role for it and its technological innovations in our search for alternative sources of energy. However the suggested strategy also recognizes the extreme dangers of relying on some technological solution to ongoing biomass burning and land degradation (desertification) and the safe storage of legacy carbon. **Restoring healthy environmental functioning on our living Earth is simply not the role of high technology, but it is essential to our survival.**

Part 7.
Leadership in Addressing Climate Change

In dealing with global climate change, we look to scientists working within various institutions or bureaucracies for information. But where do we look for direction or leadership? All too often, we look to the leaders of government or various non-government organizations, assuming they will provide it. Yet social research (such as the writings of Lord Eric Ashby "Reconciling Man and the Environment" and John Ralston Saul "Voltaire's Bastards" summarize) shows there are reasons why leadership from politicians or institutions and organizations cannot emerge in such situations. Such is the nature of holism that large organizations (known as soft systems in Systems Science), including governments, universities and environmental organizations, take on a life of their own and behave differently from the people who form them. Regardless of how intelligent or caring individuals within an institution are, the institution itself is almost watertight to new ideas if they conflict with a deep-seated belief, or paradigm, that exists within the institution or profession. In addition, the research shows that leadership can never emerge from any democratically elected leader, except in time of war. The leaders can only respond to public awareness and grassroots demand. Thus, our progress, even in so profoundly serious a situation as we face with global climate change, is slowed by the nature of institutions to resist new knowledge, and an inability of politicians, democratic governments and organizations to lead until the people at the grassroots demand that they change at which time it is safe to lead.

It's not surprising that when it comes to global climate change that the leadership is emerging from independent scholars (such as Al Gore) and entertainment industry celebrities (such as Leonardo DiCaprio) supported by prominent public figures like Prince Charles and Sir Richard Branson. These sorts of people can risk making bold statements and suggesting difficult changes because they won't be voted out of office or replaced as the head of an organization. It is only now, through the efforts of such morally courageous people, with their high public profiles and access to significant funding, that public attention has begun to focus on climate change and increasingly on calls for action.

Unfortunately, the effectiveness of celebrity leaders will be affected by the information that they receive from scientific advisors. Advised mostly by mainstream scientists currently they do not mention the need to restore degraded land, nor to end most biomass burning to mitigate climate change. This is not surprising, since most scientists, including those serving on the Intergovernmental Panel on Climate Change, work for large institutions and have focused almost exclusively on fossil fuel emissions and technological solutions for reducing them. Where there is mention of land degradation there is no recommendation that offers any hope of reversing the degradation, but unless we do we will not win this battle.

That our many institutions are in confusion about how to address the issue of desertification as we face global climate change was inevitable based on our reductionist world view and science. A

recent well researched publication by the International Range Society (Briske et al 2008) came to this conclusion: *"The rangeland profession has become mired in confusion, misinterpretation, and uncertainty with respect to the evaluation of grazing systems and the development of grazing recommendations and policy decisions "*

So, while public demand is essential to addressing global climate change, the public will have to be better informed about land degradation and the ways it can be reversed, for any action that emerges to be realistically able to address global climate change in its entirety. This paper has been written to begin to address this urgent need.

Conclusion

People and corporations fighting the idea that humans can be causing climate change by adding carbon dioxide to the atmosphere are unwittingly endangering everyone. While some people may still genuinely believe there is room for reasonable doubt about excessive atmospheric carbon from fossil fuels, no one can, by any stretch of the imagination, deny that land degradation and the dramatic spread of deserts are not entirely due to human activities. We do not know how much time we have but we do know that most current talk of action by governments is simply rearranging the deck chairs on the Titanic.

The climate changes we are already experiencing are irreversible in human timescale. Right now given the stance of the major governments, and with China opening two new coal-fired electric generation plants every five days, we are even exceeding business-as-usual-levels of fossil fuel exploitation. At the same time the policies of governments and environmental organizations dealing with desertification – reducing livestock numbers, prescribed burning, planting trees or grass, etc. - continue to accelerate the spread of deserts.

Some people claim that we cannot tackle the problem economically. We can. It is more realistic to state that we cannot afford any longer to not divert massive economic resources into a meaningful strategy. Poll the citizens of the U.S., Britain, France, Italy, Russia, China and one would find few support what is one of the largest businesses in the world today—the international arms trade. Yet the governments named are the main participants in this trade. Frankly, we have all the money in the world and cannot afford not to shift vast economic resources to addressing global climate change and the environmental deterioration that is exacerbating it. The very future of humanity and the global economy depend on speedy and well planned action.

Global climate change and land degradation have to be put on a war footing internationally – meaning that all nations need to pull together and treat this threat as we would a war. The most powerfully divisive issues we face today, such as cultural or religious differences, pale into insignificance against global climate change, which poses a greater threat to all of humanity than all the wars ever fought or imaginable.

Only through uniting and diverting all the resources required to deal with climate change *and* land degradation can we avert unimaginable tragedy. We have all the money we need. ***All we cannot buy is time***.